CLAIMS:

1. A photon source comprising:

an optical waveguide and

a material comprising at least one colour centre, the or each colour centre being arranged for photon emission and the material having been grown so that the material is bonded to the optical waveguide and in use at least some of the photons emitted by the or each colour centre are guided in the optical waveguide.

2. A photon source comprising:

an optical waveguide incorporating a material having at least one colour centre arranged for photon emission, the material being incorporated so that in use at least some of the photons emitted from the or each colour centre are guided in the optical waveguide.

3. The photon source as claimed in claim 1 or 2 wherein the or each colour centre is arranged for the emission of single photons.

4. The photon source as claimed in any one of the preceding claims being a source of single photons.

5. The photon source as claimed in any one of claims 1 to 3 being arranged for emission of entangled photons.

6. The photon source as claimed in claim 5 comprising at least two colour centres which are arranged to emit together at least two entangled photons.

7. The photon source as claimed in any one of the

preceding claims wherein the material has a diamond structure.

8. The photon source as claimed in any one of the preceding claims wherein the material is a diamond material.

9. The photon source as claimed in any one of the preceding claims wherein the material is grown on a portion of a core region of the waveguide.

10. The photon source as claimed in any one of the preceding claims wherein the material is a diamond crystal and the or each colour centre comprises a nitrogen-related colour centre.

11. The photon source as claimed in any one of claims 1 to 9 wherein the material is a diamond crystal and the or each colour centre comprises a nickel-related colour centre.

12. The photon source as claimed in any one of the preceding claims wherein the waveguide is an optical fibre.

13. The photon source as claimed in any one of claims 1 to 11 wherein the waveguide is a planar waveguide.

14. The photon source as claimed in claim 12 or 13 comprising a core region that is surrounded by a core-surrounding region which has a lower refractive index than the core region.

15. The photon source as claimed in claim 12 or 13 comprising a number of light-confining elements arranged about the core region so that light can be guided in the core region.

16. The photon source as claimed in claim 15 wherein the core region is solid and the light-confining elements result in an average refractive index of a core-surrounding region being lower than that of the core region.

17. The photon source as claimed in claim 15 wherein the light-confining elements are arranged so that a photonic crystal waveguide is formed having photonic bandgap in the core-surrounding region.

18. The photon source as claimed in any one of the proceeding claims wherein the material is positioned in a cavity which is located in the waveguide.

19. The photon source as claimed in claim 18 wherein the cavity is located in a core region of the waveguide.

20. The photon source as claimed in 18 or 19 wherein the cavity is an optical cavity.

21. The photon source as claimed in claim 2 or in any one of claims 3 to 20 when dependent on claim 2 wherein the material is embedded in the optical waveguide.

22. The photon source as claimed in claim 2 or in any one of claims 3 to 20 when dependent on claim 2 wherein the material forms a part of the waveguide.

23. The photon source as claimed in claim 2 or in any one of claims 3 to 22 when dependent on claim 2 wherein the waveguide has a diamond core that comprises the or each colour centre.

24. The photon source as claimed in claim 2 or in any one of claims 3 to 23 when dependent on claim 2 wherein at least a portion of the length of the waveguide is composed of diamond.

25. The photon source as claimed in claim 24 wherein the entire waveguide is composed of diamond.

26. The photon source as claimed in any one of the preceding claims being arranged for optical excitation of the or each colour centre.

27. The photon source as claimed in any one of the preceding claims being arranged for electrical excitation of the or each colour centre.

28. A method of fabricating a photon source comprising:
providing an optical waveguide and
growing a material adjacent or in association with the optical waveguide in a manner so that at least one colour centre is formed in the material.

29. The method as claimed in claim 28 wherein the material is grown in a manner such that the material is bonded to the optical waveguide and in use at least some of the single photons emitted from the or each colour centre are guided in the optical waveguide.

30. The method as claimed in claim 28 or 29 wherein the material is grown directly on a portion of the waveguide so that a direct bonding of the optical waveguide with the material is effected.

31. The method as claimed in any one of claims 28 to 30 comprising the additional step of forming at least one recess in the optical waveguide.

32. The method as claimed in claim 31 wherein the waveguide comprises a core and a core surrounding region and the at least one recess is formed at an end-face of the waveguide in the core region.

33. The method as claimed in claim 31 or 32 wherein the recess is formed by etching the recess in the core region using an etch-process that preferentially etches material of the core region.

34. The method as claimed in any one of claims 28 to 33 wherein the material comprises diamond crystals having the or each colour centre.

35. The method as claimed in any one of claims 28 to 34 wherein the step of growing the material involves chemical vapour deposition (CVD).

36. The method as claimed in claim 31 or any one of claims 32 to 35 when dependent on claim 31 wherein the step of growing a material comprises growing the material at an edge associated with the or each recess.

37. The method as claimed claim 31 or any one of claims 32 to 35 when dependent on claim 31 wherein the step of growing a material comprises growing the material in the or each recess.

38. The method as claimed in claim 37 wherein the material is grown at an end-face of the waveguide and the method comprises the step of splicing the end-face with an end-face of another waveguide.

39. The method as claimed in claim 37 wherein the material is grown at an end-face and in the or each recess and the method comprises the step of splicing the end-face with an end-face of another waveguide so that the or each recess is closed and forms a cavity comprising that material having the or each colour centre.

40. A method of fabricating a photon source comprising an optical waveguide, the method comprising the steps of:

fabricating an optical waveguide incorporating a material in which at least one colour centre for photon emission can be formed and

forming the or each colour centre in the material in a manner so that in use at least some of the emitted photons are guided in the optical waveguide.

41. The method as claimed in claim 40 wherein the optical waveguide has a core and the material forms a part of the core.

42. The method as claimed in claim 40 wherein the optical waveguide has a core which is composed of the material.

43. A photon source fabricated by the method as claimed in any one of claims 28 to 42.

44. A quantum key distribution system comprising the photon source as claimed in any one of claims 1 to 27.